

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

032642-004

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)

09/762585

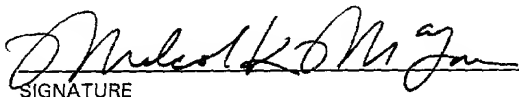
INTERNATIONAL APPLICATION NO.
PCT/AU99/00651INTERNATIONAL FILING DATE
11 August 1999PRIORITY DATE CLAIMED
11 August 1998TITLE OF INVENTION
MOLLUSC REPELLENTAPPLICANT(S) FOR DO/EO/US
Colin Leslie Young

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: WIPO Publication No. WO 00/08933 with International Search Report; and verified small entity statement.

U.S. APPLICATION NO. (If known, see 37 CFR 1.50) 09/762585		INTERNATIONAL APPLICATION NO. PCT/AU99/00651		ATTORNEY'S DOCKET NUMBER 032642-004	
17. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,000.00 (960) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 (970) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 (958) International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 (956) International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 (962) ENTER APPROPRIATE BASIC FEE AMOUNT =				\$1,000.00	
Surcharge of \$130.00 (154) for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)). 20 <input checked="" type="checkbox"/> 30 <input type="checkbox"/>				\$ 130.00	
Claims	Number Filed	Number Extra	Rate		
Total Claims	48 -20 =	28	X\$18.00 (966)	\$ 504.00	
Independent Claims	2 -3 =	---	X\$80.00 (964)	\$	
Multiple dependent claim(s) (if applicable)			+ \$270.00 (968)	\$	
TOTAL OF ABOVE CALCULATIONS =				\$1,634.00	
Reduction for 1/2 for filing by small entity, if applicable (see below).				\$817.00	-
SUBTOTAL =				\$817.00	
Processing fee of \$130.00 (156) for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)). 20 <input type="checkbox"/> 30 <input type="checkbox"/>				\$	
TOTAL NATIONAL FEE =				\$817.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 (581) per property +				\$	
TOTAL FEES ENCLOSED =				\$817.00	
				Amount to be:	
				refunded	\$
				charged	\$
a. <input checked="" type="checkbox"/> Small entity status is hereby claimed. b. <input checked="" type="checkbox"/> A check in the amount of \$ <u>817.00</u> to cover the above fees is enclosed. c. <input type="checkbox"/> Please charge my Deposit Account No. <u>02-4800</u> in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. d. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>02-4800</u> . A duplicate copy of this sheet is enclosed. NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status. SEND ALL CORRESPONDENCE TO: Teresa Stanek Rea BURNS, DOANE, SWECKER & MATHIS, L.L.P. P.O. Box 1404 Alexandria, Virginia 22313-1404 (703) 836-6620					
 SIGNATURE				Malcolm K. McGowan, Ph.D. NAME	
<u>39,300</u> REGISTRATION NUMBER					

09/762585

JC05 Rec'd PCT/PTO 09 FEB 2001

Patent
Attorney's Docket No. 032642-004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Colin Leslie Young

Application No.: TBA (National Stage Filing of
PCT/AU99/00651)

Filed: 11 August 1999

For: MOLLUSC REPELLENT

Group Art Unit: Unassigned

Examiner: Unassigned

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-cited Application on the merits, please amend the application as follows:

IN THE CLAIMS:

Please delete claims 49-54 without prejudice to or disclaimer of the subject matter contained therein.

Please amend the remaining claims as follows:

3. (Amended) A mollusc repellent composition according to claim 1 [or claim 2], wherein the metal is selected from the group of iron(II) or iron(III), [aluminium] aluminum, zinc, or copper.

5. (Amended) A mollusc repellent according to [any one of claims 2 to 4] claim 2, wherein the non-transition metal is potassium.

6. (Amended) A mollusc repellent composition according to [any one of claims 1 to 5] claim 1, wherein the metal oxalate is selected from ferric potassium oxalate or copper oxalate.

8. (Amended) A mollusc repellent composition according to [any one of the preceding claims] claim 1, wherein the amount of metal oxalate is between about 2% to 100% by weight of the total composition.

11. (Amended) A mollusc repellent composition according to [any one of the preceding claims] claim 1, wherein the carrier is water.

13. (Amended) A mollusc repellent composition according to claim 11 [or claim 12], wherein the carrier comprises between about 0% and 98% by weight of the total composition.

14. (Amended) A mollusc repellent composition according to [any one of the preceding claims] claim 1, wherein the carrier [includes] comprises a binder to facilitate the adhesion of the metal oxalate onto the surface of an article to be treated.

18. (Amended) A mollusc repellent composition according to [any one of claims 14 to 17] claim 14, wherein the binder comprises between 0.1% and 100% by weight of the carrier.

20. (Amended) A mollusc repellent composition according to [any one of the preceeding claims] claim 1 further [including] comprising a fungicide.

22. (Amended) A mollusc repellent composition according to claim 20 [or claim 21], wherein the fungicide is selected from copper oxychloride or thiram.

23. (Amended) A mollusc repellent composition according to [any on of claims 20 to 22] claim 20, wherein the fungicide is applied as a coating in combination with a small amount of a non-phytotoxic dye.

25. (Amended) A mollusc repellent composition according to [any one of the preceeding claims] claim 1, wherein the composition further comprises a diluent to enable even coverage of the article to which the repellent is to be attached.

27. (Amended) A mollusc repellent composition according to claim 25 [or claim 26], wherein the diluent comprises between about 0% to 95% by weight of the total composition.

28. (Amended) A mollusc repellent according to [any one of claims 1 to 14 and claim 16] claim 1, wherein the composition further [includes] comprises a growth hormone.

30. (Amended) A mollusc repellent composition according to claim 28 [or claim 29], wherein the growth hormone comprises between about 0.05% and 1% by weight of the total composition.

31. (Amended) A mollusc repellent composition according to [any one of claims 1 to 30] claim 1, wherein the composition comprises a metal oxalate in combination with at least one other mollusc repellent.

32. (Amended) A method for treating an article with the mollusc repellent composition according to [any one of claims 1 to 31, including] claim 1, comprising applying the repellent composition to the surface of the article to be treated.

37. (Amended) A method according to [any one of claims 32 to 36] claim 32, wherein the form of the repellent is selected from a solid, a suspension or coating composition.

40. (Amended) A mollusc repellent composition, according to [any one of claims 1 to 31] claim 1, in the form of a coating composition.

41. (Amended) A mollusc repellent composition, according to [any one of claims 1 to 10] claim 1, in the form of a paint.

47. (Amended) An article treated with [the] a mollusc repellent composition [according to any one of claims 1 to 31] according to the method of [any one of claims 32 to 39] claim 39.

REMARKS

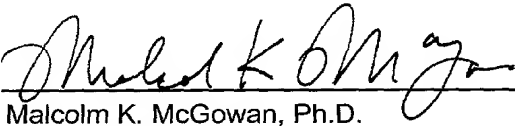
Entry of the foregoing and early and favorable consideration of the subject application is respectfully requested.

By the present amendment, omnibus claims 49-54 have been deleted without prejudice to or disclaimer of the subject matter contained therein. The remaining claims have been amended in order to remove multiple dependency, and to place them in better condition for U.S. practice. No new matter has been added.

In the event that there are any questions concerning the present amendment, or the application in general, the Examiner is respectfully urged to telephone the undersigned so that prosecution of this application may be expedited.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: 
Malcolm K. McGowan, Ph.D.
Registration No. 39,300

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Date: February 9, 2001

Patent
Attorney's Docket No. 032642-004

Applicant or Patentee: COLIN LESLIE YOUNG

Application or Patent No.: _____

Filed or Issued: _____

For: MOLLUSC REPELLENT

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 C.F.R. §§ 1.9(f) AND 1.27(e)) - SMALL BUSINESS CONCERN**

I hereby declare that I am

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN Multicrop (Aust.) Pty Ltd

ADDRESS OF CONCERN 926 Mountain Highway, Baywater, Victoria, 3153,
Australia

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 37 C.F.R. § 1.21 for purposes of paying reduced fees under Sections 41(a) and 41(b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average, over the previous fiscal year of the concern, of the persons employed on a full-time, part-time, or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled by inventor(s) described in

- ☒ the specification filed herewith
☐ Application No. _____, filed _____
☐ Patent No. _____, issued _____

If the rights held by the above-identified small business concern are not exclusive, each individual, concern, or organization having rights to the invention is listed below,* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 C.F.R. § 1.9(d), or by any concern that would not qualify as either a small business concern under 37 C.F.R. § 1.9(d) or a nonprofit organization under 37 C.F.R. § 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 C.F.R. § 1.27.)

Application No. _____
Attorney's Docket No. 032642-004

NAME _____

ADDRESS _____

☐ individual ☐ small business concern ☐ nonprofit organization

NAME _____

ADDRESS _____

☐ individual ☐ small business concern ☐ nonprofit organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earlier of the issue fee and any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 C.F.R. 5 1.28(b).)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code; and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING COLIN LESLIE YOUNG

TITLE OF PERSON OTHER THAN OWNER Consultant

ADDRESS OF PERSON SIGNING 27 Reynolds Road, Wattle Glen, Victoria, 3096,
Australia

SIGNATURE X [Signature] DATE 19.02.01

MOLLUSC REPELLENT

Field of the Invention

The present invention relates to a repellent for molluscs. More particularly, the present invention relates to a mollusc repellent, which is environmentally friendly being both non-phytotoxic and harmless to non-target animals, and therefore suitable for use in sustainable agriculture, where the use of toxic chemicals is unacceptable.

Background to the Invention

Slugs and snails are major pests of agriculture in many parts of the world. One particular species of slug, the grey field slug, *Deroceras reticulatum*, is a common horticultural and agricultural pest in Australia, which causes extensive damage to agricultural crops and garden plants.

Significant crop damage by slugs and snails also occurs in the United Kingdom, Northern Europe, the Middle East, North and Central America, South East Asia, Japan and New Zealand. In many cases, the rise to pest status of the slug in question is a consequence of change - either in distribution (as in the case of accidental or deliberate introductions) or in agricultural practice.

In the recent past, fields awaiting seed planting were subjected to a thorough ploughing which actually resulted in the destruction of slug populations submerged beneath the surface of the soil. This maximum tillage of the soil, though, was found to destroy many beneficial characteristics of the soil structure. More recently, in order to reduce expenditure involved in such thorough ploughing and to overcome the difficulties associated with ploughing in muddy, boggy soils, the practice of minimum tillage and the use of drill holes has increasingly been adopted prior to seed planting. The advent of minimum tillage has contributed significantly to the level of slug populations rising to pest status.

- 2 -

Slugs are a major agricultural pest causing significant crop damage because they bury themselves in the soil and then move into the drill holes into which new crop seeds have been planted. Once the seed has been placed in the drill holes, the slugs attack the seed and eat the inside
5 essentially leaving an empty husk, thereby potentially destroying the whole planting. There is therefore an urgent need for a method of protecting seeds from destruction by slugs prior to the seeds being planted.

There are several other instances where a solution to deal with
10 slug populations is required. For example, in order to control weeds and reduce moisture loss by evaporation, it has been common practice to employ sheets of black polythene laid on the ground around the plants and under organic mulching material. The problem associated with such sheets is that they have to be dug up to dispose of them, they are
15 unsightly and they do not allow passage of water through them. Clearly, the use of such material, which is non-biodegradable, is environmentally unacceptable.

One solution to this problem, which is the subject of Australian Patent No. AU-B-64756/94, has been to employ recycled newspaper waste by reconstituting it into matting, in the form commonly known as
20 "weed mats." Such matting is environmentally friendly since it employs a recycled resource which naturally decomposes. The problem encountered in the use of such matting, however, is that the recycled paper mat is attacked by slugs present in the soil upon which the matting is laid. This
25 attack reduces the effective lifespan of the matting thereby making such a slug barrier unattractive to consumers. In addition, the laying of such matting is very labour-intensive and time-consuming and it would be preferable if the time interval between successive applications could be extended as much as possible. None of the molluscicides presently
30 available on the market are suitable for this application since their efficacy

reduces rapidly on contact with water and so would be ineffective in extending the lifespan of the weed mats.

Another case where slugs present a problem is in the agricultural practice of growing brussel sprouts. These crops present one of the few
5 instances where slugs actually move up onto the plant and shelter in the plant itself, rather than stay in the soil and attack the root system. The problem presented in this case is that a slug repellent is required which is non-phytotoxic as well as being harmless to human beings, the eventual consumers of the crop. A further problem is that the slug repellent cannot
10 be in the form of a pellet, but rather in the form of a spray since the repellent has to coat the leaves of the plant. Preferably, the slugs must be prevented from climbing up onto the plants at a very early stage because once they have done so, it has previously been found to be very difficult to remove them. It has been proposed that growers confronted with this
15 problem may use a surfactant repellent such as CeTAB, cetyl tertiary ammonium bromide. However, the efficacy of this repellent is short-lived, since the compound is soluble and washes off in the rain or during overhead irrigation.

As was also mentioned above, one of the ways in which mollusc
20 populations can achieve pest status is that they can be accidentally introduced. One such mode of accidental introduction is where molluscs attach themselves onto the hulls of ships which move from port to port. One way in which such accidental introductions could be prevented is for a mollusc repellent to be applied to the ship's hull thereby preventing the
25 initial harbouring of the mollusc. In the United States, a considerable problem has been encountered in the control of the introduced Zebra mussel, which attaches itself to the inlet and outlet pipes of cooling systems for industrial power generators. This mollusc has now reached plague proportions. To solve the mollusc problems encountered in these
30 two aquatic situations, care has to be taken to apply a mollusc repellent that is not soluble and does not endanger aquatic life. None of the known

mollusc repellents would be useful in this application all being either too soluble or too toxic.

Chemical methods (i.e. the use of molluscicides), involving the use of stomach poisons for the control of these pests, are well known.

5 Molluscicides containing metaldehyde and methiocarb have been in use for some time, but these are themselves toxic to non-target animals and human beings and in the form of pellets, they also deteriorate upon exposure to water and in particular, rain and are not sufficiently durable as long-term repellents.

10 The use of metal complexes in molluscicides was first disclosed in Australian Patent AU-B-22526/88 entitled: "Aluminium(III) and Iron(III) complexes exhibiting molluscicidal activity", in the name of Henderson et al. In one of their studies, these inventors compared the relative toxicities of some aluminium and iron salts and chelates and their efficacies as
15 stomach poisons by injecting known amounts into the gut lumen of molluscs and they found that the metal chelates were more toxic than their corresponding salts. Metal chelates were also first trialed by Henderson et al as contact-action poisons. In one particular study, Henderson used the metal chelate, FeEDTA, as the toxic agent, finding it just as effective
20 as various salts of Fe(III). (Henderson, I.F. et al, in "A New Group of Molluscicidal Compounds," BCPC mono , (1989), 41, "Slugs and Snails in World Agriculture", pp 289-294 eds. Henderson, I.F , British Protection Council, Farnham, U.K.). More recently, Australian Patent No. 683405 entitled: "Ingestible Mollusc Poisons," disclosed a terrestrial mollusc
25 stomach poison containing as the active ingredient either ferric edetate or the ferric hydroxy-ethyl derivative of edetic acid. These workers have also shown that mixtures of iron salts such as ferric sulphate, ferric chloride or ferric nitrate when mixed together with disodium EDTA or EDTA, as such, are toxic to the slug species, *Deroceras reticulatum*. The present inventor
30 has also developed a stomach-action molluscicide, disclosed in Australian Patent Application No: 689399, containing the oxo-dimer, [EDTA-Fe-O-

Fe-EDTA]4- as the active ingredient wherein the bait formulation itself was found to be more palatable to molluscs and therefore also more efficacious. While metal chelate-derived molluscicides are preferable to the use of the more toxic alternatives, such molluscicides are all soluble
5 and are therefore not applicable to any of the problems outlined above.

Dawson et al, in BCPC Symposium Proceedings, (1996), 66, "Slug & Snail Pests in Agriculture," p 439-444, eds. Henderson, I.F., British Protection Council, Farnham, U.K.) have investigated the repellency of a range of surfactants to the slug, *Deroceras reticulatum*. They found that
10 in particular, tetraammonium salts were highly repellent and some polyphenylpolyethoxylates were also repellent with the degree of repellency varying with the degree of ethoxylation. These workers were interested in using surfactants as a repellent to crops. Their laboratory tests showed that crawling slugs rapidly detect and are deterred by topical
15 applications of chemicals at low deposit rates. They concluded however, that surfactants were of limited use in this type of application, since they were rapidly removed from the plant by rain, by condensation or by irrigation spraying.

Mollusc repellent formulations commonly in use contain
20 methiocarb, copper sulphate, aluminium sulphate, ammonium alum and thiram to mention a few. Aluminium sulphate and ammonium alum work as taste repellents, whilst methiocarb and thiram are toxic poisons. Copper sulphate and copper oxychloride have been used for some time as slug repellents but they are too soluble to be effective as a slug
25 repellent for the above-mentioned application to seeds and moreover both have a low LD50 value (see Table 1) by virtue of them being soluble and therefore being able to enter the blood stream by biochemical degradation. In addition, they are both phytotoxic. Copper silicate, which is the subject of Australian Patent Application No AU-B-27621/92, is also
30 believed to function as a fungicide and a pesticide. Although this compound is not phytotoxic, it is too soluble to be able to function

effectively as the active ingredient in a durable mollusc repellent composition for a seed coating or for any of the applications mentioned above.

Accordingly, it is an object of the present invention to provide a mollusc repellent which achieves the hitherto unavailable requirement of prolonged repellency. It is also an object of the present invention to provide a mollusc repellent, which is environmentally friendly being both non-phytotoxic and harmless to non-target animals, and therefore suitable for use in sustainable agriculture, where the use of toxic chemicals is unacceptable.

The present study concentrated on finding an active ingredient, for both horticultural and agricultural purposes, which acted both as a repellent to molluscs and one that remained efficacious in field conditions on prolonged exposure to the environment. To this extent, the study was also directed to finding a mollusc repellent that was effective in both marine and fresh-water environments. The results of trials conducted on several metal complexes revealed that some metal oxalates, and copper oxalate, in particular, when applied in either humid or moist environments, showed a surprisingly propensity to remain efficacious for a prolonged period of time.

In addition, the acute toxicity of copper oxalate is not known, but it is estimated that the toxicity is low (i.e. greater than 1000 mg/kg of body weight). This estimation is based on the following reasoning. Copper oxalate has extremely low solubility in water over a considerable range of pH. It is thought that only a minuscule amount of copper oxalate will be absorbed in the mammalian gut. The toxicity of a range of copper compounds is known and these are summarised in Table 1. It is apparent that compounds with low solubility are not very toxic. Oxalates are known to be toxic and some data are given in Table I. Oxalates occur in a wide range of natural products including some foods, such as tea, wheat, spinach and rhubarb. Actual poisoning by oxalate is known to arise more

- 7 -

from natural sources than from synthetic materials. It appears that the toxicity of oxalates is due to the fact that they chelate metals that are needed for biochemical/metabolic processes.

Copper oxalate itself occurs naturally in the soil due to the decomposition of organic matter. The fact that copper oxalate is very insoluble seems to be employed by certain common soil fungi, *Aspergillus niger*, which has been found to solubilize a number of minerals including cuprite, Cu_2O with no reduction in growth rate. (Sayer, J.A., Kierans, M. and Gadd, G.M., "Solubilisation of some Naturally Occurring Metal-bearing Minerals, Limescale and Lead Phosphate by *Aspergillus niger*," FEMS Microbiology Letters, (1997), 154, 29-35, published by Elsevier). After one to two day's growth on cuprite at 25°C , a precipitate of copper oxalate was observed. It was suggested that this oxalate formation represented a reduction in bioavailability of toxic cations and represented an important means of toxic metal immobilisation of physiological and environmental significance. A certain amount of copper is, of course essential for both plant and animal life, it being an important co-enzyme in a number of biochemical reactions. The average daily requirement for man is estimated to be 2-5 mg per day (Henry Osiecki, "Nutrients in Profile," (1995), published by Bioconcepts Pty Ltd)

Summary of the Invention

According to one aspect of the present invention, there is provided a mollusc repellent composition including an effective amount of a substantially insoluble metal oxalate and a suitable carrier therefor.

Preferably, the metal of the metal oxalate is selected from a transition metal or a transition metal in combination with a non-transition metal. More preferably, the metal is selected from the group of iron(II) or iron(III), aluminium, zinc or copper. Most preferably, the metal is copper. Preferably, the non-transition metal is potassium. Preferably, the metal

oxalate is selected from ferric potassium oxalate or copper oxalate. Most preferably, the metal oxalate is copper oxalate.

Typically, the amount of metal oxalate required for efficacy is between about 2% and 100% by weight of the total composition of the repellent. Preferably, the amount of metal oxalate is between about 2% and 10% by weight of the total composition. Most preferably, the amount is about 5% by weight of the total composition.

Preferably, the carrier of the composition is water, such that the metal oxalate forms an aqueous suspension. Preferably, the carrier comprises between about 0% and 98% by weight of the total composition.

Typically, the repellent composition is applied to an article from which it is desired to repel molluscs. Preferably, the article includes animate and inanimate articles. More preferably, the animate article is selected from seeds, including wheat, barley, grass (clover, phalaris, rye and cocksfoot), canola seeds, fruit or vegetables. More preferably, the inanimate article is selected from weed mats, inlet and outlet pipes for cooling systems, hulls of ships and other sub-aqueous structures, driveways or parking aprons of homes and grow-bags, but is not limited to these.

The mollusc repellent is advantageously presented in a solid form, such as tablets, powders, granules, as a suspension or as a coating composition. Preferably, the coating composition is in the form of a paint. Those skilled in the art will appreciate that it is preferable to prepare the products, which are the subject of the invention, in a form that is easy for consumers to use.

In a preferred form of the invention, the carrier of the composition includes a binder, which facilitates the adhesion of the metal oxalate onto the surface of the article to be treated. Preferably, where the repellent composition is to be applied to an animate article, the binder is selected from gum arabic or gum acacia. Preferably, where the repellent is to be

applied to inanimate articles, the binder is selected from a waterproof binder such as paraffin wax, white oil, casein or polyvinylacetate. Preferably, the binder comprises between about 0.1% and 100% by weight of the carrier of the composition. More preferably, the binder
5 comprises 0.5% to 3% by weight of the carrier.

Preferably, the composition further includes a fungicide such that the article is protected from attack by a fungus. Preferably, the fungicide is selected from copper oxychloride or thiram. Preferably, the fungicide comprises about 0.05% to 1.0% by weight of the total composition.

10 Typically, the fungicide is applied as a coating in combination with a small amount of a non-phytotoxic dye, the latter being used as an indicator that the seeds have been treated with a fungicide. Preferably, the non-phytotoxic dye comprises less than about 1% by weight of the total composition.

15 Preferably, the carrier further comprises a diluent to ensure even coverage of the article to which the repellent is to be applied. Preferably, the diluent is selected from a silicate, gypsum or limestone. Preferably, the diluent comprises between about 0 % to 95% by weight of the carrier.

According to yet another aspect of the invention, the composition
20 comprises a metal oxalate in combination with at least one other mollusc repellent.

Preferably, where the treated article is a seed having the potential to produce at least one root, the composition further includes a growth hormone such that the hormone is readily available to the at least one root
25 as it emerges from the seed. Preferably, the growth hormone is a seaweed extract. Preferably, the growth hormone comprises between about 0.05% and 1% by weight of the total composition.

In another preferred embodiment, the repellent composition is in the form of a paint, wherein the carrier is preferably selected from an

aqueous surfactant solution, an aqueous polyvinylacetate solution or an oil-based paint.

The mollusc repellent may also conveniently be presented as a two-part composition, wherein the first part comprises an effective amount
5 of an aqueous solution of oxalic acid or soluble metal oxalate and the second part comprises an effective amount of an aqueous solution of a soluble metal salt, whereby sequential application of the two solutions, in either order, results in the in-situ preparation of a substantially insoluble metal oxalate as an aqueous suspension. Preferably, the metal oxalate is
10 selected from ferrous oxalate, ferric ammonium/potassium oxalate or copper oxalate. Preferably, the oxalic acid and the metal salt are present in equimolar amounts. Preferably further, the concentration of the metal salt solution is about 5% by weight of the total two-part composition. Such use of two environmentally acceptable chemicals renders such a mollusc
15 repellent suitable for sustainable agriculture purposes.

According to another aspect of the invention, there is provided a method of treating an article with the mollusc repellent, which is the subject of the invention, including applying the composition to the surface of the article to be treated. Tablets, powders or granules can be sprinkled
20 over the ground or in places where molluscs congregate, such as letterboxes, to repel the molluscs. An aqueous suspension of metal oxalate composition as detailed above can be used for coating seeds, for spraying on driveways, for spraying on the trunks of fruit trees or on vegetable seedlings, such as brussel sprouts. A repellent composition can
25 be applied either in the solid form, by sprinkling on the surface of, or in the form of a coating composition by coating on the surface of, the lining of grow-bags, used by the home gardener, or on at least one of the layers that comprise "weed mats", as described above. A repellent composition in the form of a paint, can be applied to sub-aqueous surfaces which are
30 potentially susceptible to mollusc colonies forming thereon, such as inlet and outlet pipes for cooling systems or on the hulls of ships, to prevent

the introduction of foreign species of unwanted molluscs from other parts of the world.

According to another aspect of the invention, the invention provides an article, which has been treated with the mollusc repellent composition.

- 5 Preferably, the treated article is selected from a seed, a weed mat, a citrus tree, a driveway, a sub-aqueous structure such as an inlet or outlet pipe or a ship's hull, a grow-bag, a vegetable seedling, but is not limited to one of these

- 10 The scope of the present invention also extends to the use of the mollusc repellent composition by, for example, spreading the repellent composition in a solid form as tablets, granules or as a powder; by coating animate or inanimate articles with the composition, for example, by spraying vegetable seedlings or driveways with an aqueous suspension of the repellent composition; by applying a paint including the composition
- 15 to sub-aqueous inlet or outlet pipes, ships' hulls or any other sub-aqueous structure where molluscs are likely to congregate; or by coating layers of decomposable material incorporated into weed mats with the composition
- These examples for the use of the composition are by no means limiting.

Examples

- 20 The oral toxicity of several soluble copper compounds and oxalates which have been extracted from "SAX'S Dangerous Properties of Industrial Materials," edited by Lewis, R.J , are given in Table 1. LD50 values have generally been given for the rat since these were available for all the chemicals of interest in this study. However, where available,
- 25 LD50 values for human beings have also been given

Table 1. Oral Toxicity of several soluble copper compounds and oxalates

<u>Chemical Compound</u>	<u>LD50 (Rat) mg/kg</u>	<u>LD50(Human) mg/kg</u>
Copper acetate	595	
Copper oxychloride	700	
Copper citrate	1580	
Copper nitrate	940	
Copper sulphate	300	50
Copper hydroxide		200
Oxalic acid	7500	
Potassium oxalate	660	

- 5 The results in Table 1 show that several copper compounds have shown quite considerable toxicity to the rat and to the human being, whereas because copper oxalate is insoluble, its LD50 values both for the rat and the human being would be expected to be large

10 The invention will now be illustrated with reference to the following non-limiting Examples

Example 1.

15 There are many possible variables to consider when evaluating mollusc repellents. Field trials are often poorly controlled and it is often difficult to arrive at unambiguous conclusions. It is impossible to apply extensive statistical analysis to poorly designed or controlled experiments. However, a series of simple experiments in which variables are controlled lead to unambiguous conclusions with no need for statistical analysis. It

was decided to compare the repellents under laboratory conditions, which could closely mimic controlled field conditions

Repellency of the test compounds was tested using the sectorised filter technique of Bowen and Antoine (see Bowen, I D and Antoine, S.,
5 "Molluscicide Formulation Studies," **International Journal of Pest Management**, (1995), **41(2)**, 74-78.)

The compounds tested were copper oxalate and CeTAB (cetyl tertiary ammonium bromide). One sector of the filter paper was used as the control and this was moistened with distilled water (1 ml). The other
10 half was moistened with the test compound. The copper oxalate used in the trial was insoluble and so was rubbed into the filter paper and the weight of the solid held on the filter paper was calculated. The paper containing the copper oxalate was moistened with water after the addition of the chemical.

15 Filter sectors were placed on the lid of a plastic tub. The tub was inverted and was used to make a closed test arena. A small gap of 2 mm was left between the two filter sectors so as to prevent mixing of the test paper with the control. One juvenile *Helix aspersa* was introduced to the control sector and was allowed to remain in the arena overnight

20 Attractancy / repellency was detected by dusting the filter paper with charcoal to reveal the slug trails. The results were quantified by placing a transparent grid over the test sectors and measuring the area covered by snail trails. Any phagostimulatory effect of the test compound was indicated by the consumption of the treated paper

25 **Results**

The results of the arena trials including the final position of each snail at the end of the experiment, the percentage of the filter paper section eaten and the percentage trail cover are shown in Table 2.

Table 2. Results of attractancy / repellency tests on Copper oxalate and CeTAB

Treatment	Concentration (mg/cm ²)	Final Position	% Sector Eaten		% Covered	
			Test	Control	Test	Control
Control		C	5	3	84	88
		C	5	1	88	80
		T	0	5	88	77
CeTAB	0.2	R	0	2	20	86.7
	0.2	R	0	4	22	77.8
	0.2	R	0	1	42.2	75.6
	2.0	R	0	4	0	62.2
	2.0	R	0	5	0	66.6
	2.0	R	0	3	0	71.1
	2.11	R	0	5	0	71.1
Copper oxalate	1.61	R	0	4	4.4	88
	2.43	R	0	2	0	68.9
	2.47	R	0	5	0	86.7
	3.46	R	0	1	4.4	66.7
	3.19	C	0	2	0	88

where R: roof of the container; T = test sector, and C = control sector.

Summary of Results

The results show that snails were strongly repelled by the copper
 5 oxalate. In all, of the six snails tested, none were found in the test
 at the end of the experiment and there was no consumption of the test
 filter paper. There was very little mucous cover compared to the control

The positive control, CeTAB, was also found to act as a repellent. Indeed, there was a concentration-related response, more snails being repelled by 2.0 mg/l CeTAB, compared to 0.2 mg/l CeTAB

Example 2.

- 5 In the following experiment, various seeds were coated with copper oxalate and ferric potassium oxalate, respectively and fed to the slug, *Deroceras reticulatum*. The damage to these seeds was compared to damage to control seeds, which were left untreated. The percentage of seeds that were damaged was calculated and is given in Table 3.

Table 3. Protection afforded to seeds by Copper oxalate and Ferric potassium oxalate

Treatment	% Seeds damaged		% Seeds damaged		% Seeds damaged
	Wheat seeds		Pea seeds		Broad beans
	After		After		After
	5 days	7 days	5 days	7 days	7 days
Control	37	87	15	33	5
Copper oxalate	0	2	7	7	5
Ferric potassium oxalate	3	20	15	17	0

10

Summary of Results

It can be seen from the above results that copper oxalate is a very effective slug repellent for wheat and pea seeds.

Example 3.

In the following experiment, the efficacy of copper oxalate for the protection of seeds was tested and compared to **BAYSOL®** and **MULTIGUARD®**. The results are shown in Table 4. Seeds were coated
 5 with an aqueous suspension of copper oxalate, dried and fed to the slug, *Deroceras reticulatum*

Table 4. Protection afforded to wheat and pea seeds by copper oxalate compared to BAYSOL® and MULTIGUARD®

Treatment	% Seeds damaged	
	Wheat seeds	Pea seeds
	After 9 days	After 7 days
Control	72	23
Copper oxalate	10	8
MULTIGUARD®		2
BAYSOL®	10	4

MULTIGUARD® and **BAYSOL®** are registered trade marks of Multicrop® (Aust.) Pty Ltd and Bayer, respectively.

Summary of Results

10 The above results show that copper oxalate dramatically reduces the amount of damage to wheat seeds and does so to the same extent as **BAYSOL®**, a toxic molluscicide containing methiocarb. Copper oxalate was also found to be effective at protecting pea seeds from damage by slugs although not as effectively as **MULTIGUARD®** which was more
 15 effective than **BAYSOL®**. These latter two products also resulted in the death of the slugs involved in the trial.

Example 4.

In the following experiment, the repellency of copper oxalate was investigated when incorporated in a paint composition. In this example, the carrier used was a common aqueous PVA solution sold in Australia
 5 under the brand name of **Bond Crete**

Thirty-three 1 litre containers were used each with 3 layers of paper towel covering the bottom of the container. Half of the uppermost surface of each of the paper towels was coated with a solution made from 1 part copper oxalate : 10 parts water : 1 part PVA emulsion. This coating was
 10 applied at a rate of about 2 ml per 100 cm² and allowed to dry. The towel was then moistened with approximately 20 ml of water. One snail, *Cernuella virgata*, was placed in the centre of the paper towels at the border of the coated and the uncoated half in each container. The snails were observed to move away from the coated area or move along the
 15 border without moving on to the coated area. Some of the snails were observed to move away from the bottom of the container at night, but most returned to the moist paper towel in the morning. The snails consumed some of the untreated paper. No consumption of the treated paper was detected. After 7 days, the number of snails on the treated and untreated
 20 sections of the paper towel were counted, together with the number on the sides and lid of the container. The results are shown in Table 5.

Table 5. Investigation of the repellency of copper oxalate in a coating composition

25

Area where snail located in container	No. of snails in area
On lid of container	1
On side of container	1
On treated half of paper	8
On untreated half of paper	23

Summary of results

These results show that when incorporated into a coating
5 composition, copper oxalate functions effectively as a mollusc repellent

Those skilled in the art will appreciate that the invention described
herein is susceptible to variations and modifications other than those
specifically described. It is to be understood that the invention includes all
such variations and modifications. The invention also includes all of the
10 steps, features, compositions and compounds referred to or indicated in
this specification (unless specifically excluded) individually or collectively,
and any and all combinations of any two or more of said steps or features.

Where the terms "comprise", "comprises", "comprised" or
"comprising" are used in this specification, they are to be interpreted as
15 specifying the presence of the stated features, integers, steps or
components referred to, but not to preclude the presence or addition of
one or more other feature, integer, step, component or group thereof.

CLAIMS

1. A mollusc repellent composition including an effective amount of a substantially insoluble metal oxalate and a suitable carrier
5 therefor

2 A mollusc repellent composition according to claim 1, wherein the metal of the metal oxalate is selected from a transition metal or a transition metal in combination with a non-transition metal.

3. A mollusc repellent composition according to claim 1 or
10 claim 2, wherein the metal is selected from the group of iron(II) or iron(III), aluminium, zinc or copper

4. A mollusc repellent composition according to claim 3, wherein the metal is copper

5. A mollusc repellent composition according to any one of
15 claims 2 to 4, wherein the non-transition metal is potassium.

6 A mollusc repellent composition according to any one of claims 1 to 5, wherein the metal oxalate is selected from ferric potassium oxalate or copper oxalate

7. A mollusc repellent composition according to claim 6,
20 wherein the metal oxalate is copper oxalate.

8. A mollusc repellent composition according to any one of the preceeding claims, wherein the amount of metal oxalate is between about 2% to 100% by weight of the total composition.

9 A mollusc repellent composition according to claim 8,
25 wherein the amount of metal oxalate is between about 2% and 10% by weight of the total composition.

10. A mollusc repellent composition according to claim 9, wherein the amount is about 5% by weight of the total composition.

- 20 -

11. A mollusc repellent composition according to any one of the preceeding claims, wherein the carrier is water.

12 A mollusc repellent composition according to claim 11, wherein the metal oxalate is present as an aqueous suspension.

5 13. A mollusc repellent composition according to claim 11 or claim 12, wherein the carrier comprises between about 0% and 98% by weight of the total composition.

14 A mollusc repellent composition according to any one of the preceeding claims, wherein carrier includes a binder to facilitate the
10 adhesion of the metal oxalate onto the surface of an article to be treated.

15 15 A mollusc repellent composition according to claim 14, wherein the article is selected from an animate or an inanimate article.

16. A mollusc repellent composition according to claim 15, wherein the binder is selected from gum arabic or gum acacia where the
15 repellent is to be applied to an animate article.

17. A mollusc repellent composition according claim 15, wherein the binder is selected from a waterproof binder such as paraffin wax, white oil, casein or polyvinylacetate where the repellent is applied to inanimate articles.

20 18. A mollusc repellent composition according to any one of claims 14 to 17, wherein the binder comprises between 0.1% and 100% by weight of the carrier.

19. A mollusc repellent composition according to claim 18, wherein the binder comprises between 0.5 and 3% by weight of the
25 carrier.

20. A mollusc repellent composition according to any one of the preceeding claims further including a fungicide.

21. A mollusc repellent composition according to claim 20, wherein the fungicide comprises about 0.05% to 1.0% by weight of the total composition.

22. A mollusc repellent composition according to claim 20 or
5 claim 21, wherein the fungicide is selected from copper oxychloride or thiram.

23. A mollusc repellent composition according to any one of claims 20 to 22, wherein the fungicide is applied as a coating in combination with a small amount of a non-phytotoxic dye.

10 24. A mollusc repellent composition according to claim 23, wherein the non-phytotoxic dye comprises less than about 1% by weight of the total composition

25. A mollusc repellent composition according to any one of the preceding claims, wherein the composition further comprises a diluent
15 to enable even coverage of the article to which the repellent is to be applied.

26. A mollusc repellent composition according to claim 25, wherein the diluent is selected from a silicate, gypsum or limestone.

27. A mollusc repellent composition according to claim 25 or
20 claim 26, wherein the diluent comprises between about 0% to 95% by weight of the total composition

28. A mollusc repellent composition according to any one of claims 1 to 14 and claim 16, wherein the composition further includes a growth hormone.

25 29. A mollusc repellent composition according to claim 28, wherein the growth hormone is a seaweed extract

30. A mollusc repellent composition according to claim 28 or claim 29, wherein the growth hormone comprises between about 0.05% and 1% by weight of the total composition.

31. A mollusc repellent composition according to any one of claims 1 to 30, wherein the composition comprises a metal oxalate in combination with at least one other mollusc repellent.

32. A method for treating an article with the mollusc repellent composition according to any one of claims 1 to 31, including applying the repellent composition to the surface of the article to be treated.

33. A method according to claim 32, wherein the article to be treated is selected from an animate or an inanimate article.

34. A method according to claim 33, wherein the animate article is a seed having the potential to produce at least one root, and the growth hormone is readily available to the at least one root as it emerges from the seed.

35. A method according to claim 34, wherein the seed selected from the group of wheat, barley or clover seeds, phalaris, rye or cocksfoot grass seeds, canola seeds, fruit or vegetable seeds

36. A method according to claim 33, wherein the inanimate article is selected from weed mats, inlet and outlet pipes for cooling systems, hulls of ships, driveways of homes or grow-bags.

37. A method according to any one of claims 32 to 36, wherein the form of the repellent is selected from a solid, a suspension or coating composition.

38. A method according to claim 37, wherein the solid form of the repellent is selected from tablets, granules or a powder

39. A method according to claim 37, wherein the suspension is in the form of a spray.

40. A mollusc repellent composition, according to any one of claims 1 to 31, in the form of coating composition.

41. A mollusc repellent composition, according to any one of claims 1 to 10, in the form of a paint.

- 23 -

42. A mollusc repellent composition according to claim 41, wherein the carrier is selected from an aqueous surfactant solution, an aqueous polyvinylacetate solution or an oil-based paint.

43. A mollusc repellent composition suitable for sustainable
5 agricultural purposes including:

- (i) an effective amount of an aqueous solution of oxalic acid or soluble metal oxalate, and
- (ii) an effective amount of an aqueous solution of a soluble metal salt,

10 whereby sequential application of the two solutions, in either order, results in the in-situ preparation of a substantially insoluble metal oxalate as an aqueous suspension.

44. A mollusc repellent composition according to claim 42,
15 wherein the metal oxalate is selected from ferrous oxalate, ferric ammonium/potassium oxalate or copper oxalate

45. A mollusc repellent composition according to claim 43, wherein the oxalic acid and the metal salt are present in equimolar amounts.

20 46. A mollusc repellent composition according to claim 44, wherein the concentration of the metal salt solution is about 5% by weight of the total composition.

47. An article treated with the repellent composition according to any one of claims 1 to 31 according to the method of any one of claims
25 32 to 39.

48. An article according to claim 46, wherein the treated article is selected from a seed, a weed mat, a citrus tree, an inlet or outlet pipe, a ship's hull, a grow bag or a vegetable seedling.

49. Use of the mollusc repellent composition according to any one of claims 1 to 31 substantially as hereinbefore described with reference to any one of the Examples.

50. A mollusc repellent composition according to any one of
5 claims 1 to 31 substantially as hereinbefore described with reference to any one of the Examples.

51. A method of for treating an article with the mollusc repellent composition according to any one of claims 1 to 31, substantially as hereinbefore described with reference to any one of the Examples.

10 52. A coating composition according to claim 40, substantially as hereinbefore described with reference to any one of the Examples.

53. A paint according to claim 41 or claim 42, substantially as hereinbefore described.

15 54. A mollusc repellent composition suitable for sustainable agriculture purposes according to any one of claims 42 to 45, substantially as hereinbefore described.

ABSTRACT

A mollusc repellent, which includes a substantially insoluble metal oxalate and a suitable carrier therefor, which exhibits prolonged efficacy.

- 5 The mollusc repellent is environmentally friendly, being both non-phytotoxic and harmless to non-target animals, and is therefore suitable for use in sustainable agriculture, where the use of toxic chemicals is unacceptable. The mollusc repellent can be used in the form of a solid or as a coating composition

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PAGE 04

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
Includes Reference to Provisional and PCT International Applications)

Attorney's Docket No.

032642-004

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name;
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor
(if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention
entitled:

MOLLUSC REPELLENT

the specification of which (check only one item below):

- ☐ is attached hereto.
- ☐ was filed as United States application
Number _____
on _____
and was amended _____ (if applicable).
on _____
- ☒ was filed as PCT international application
Number PCT/AU99/00651
on 11 August, 1999
and was amended _____ (if applicable).
on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims,
as amended by any amendment referred to above.

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COUNTRY If PCT, indicate "PCT"	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. §119
Australia	PP 5183	11/8/1998	<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
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Attorney's Dock# No.

032642-004

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PAGE 05

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Includes Reference to Provisional and PCT International Applications

Attorney's Docket No.
032642-004

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